Section 9 Sevier River Basin
WATER PLANNING AND DEVELOPMENT

Tables

Figures

Water Planning and Development

Water planning is essential to ensure that development and conservation will meet all of the future needs of the resources' users.

9.1 INTRODUCTION

This section describes the major existing and proposed water planning and development activities in the Sevier River Basin. It also discusses the problems and needs and alternative solutions.

The existing water supplies are essential to the existence of local agricultural and industrial interests and the local communities. At the same time, water resources can provide aesthetic and environmental values and meet the recreational needs, not only of the local residents, but of others outside the area.

A goal of this plan and the Division of Water Resources is to assist local entities and to help them coordinate with other state and federal agencies in effective water resources management. However, the primary decision-making process is still the responsibility of the local people. This plan provides local decision makers with data and information to help solve existing problems and to plan for future implementation of the most viable alternatives.

9.2 BACKGROUND

Water resources development began at the time each community was settled. Facilities usually consisted of small earth or earth and brush structures to divert water for irrigation and stock uses, oft times on an individual basis. Drinking water was supplied by springs or taken directly from streams. Later, it was found more convenient to organize formal groups such as irrigation companies, cities and towns.

9.2.1 Early Settlement and Water Development

The first settlers arrived in Sanpete County in 1849. The following spring of 1850, they were the first in recent history to divert irrigation water in the Sevier River Basin. Soon there were settlements throughout the basin from Pahvant Valley (185 1) to Grass Valley (1867).

As soon as the settlements were established, settlers started developing local water resources for domestic use and irrigation until they were interrupted by the Walker and Black Hawk Indian wars. The diversion dam at Hinckley (Oasis) was constructed in 1860. It washed out and was rebuilt at least 5 times. The Richfield Irrigation Canal was constructed in 1865. This 1 l-mile long canal was dug mostly with pick and shovel and completed in five weeks. Scipio Reservoir was constructed in 1860, the first storage reservoir in the Sevier River Basin. Storage was added to Panguitch Lake when the dam was completed in 1872. By the turn of the century, several dams for storage of irrigation water were under construction throughout the river system. Section 3 describes early water history in more detail.

The irrigation of lands continued to expand, and along with a more reliable water supply, water tables began to rise in the irrigated areas. This created the need to leach soluble salts out of the vegetative root zone so crop growth would not be restricted. As a result, 14 drainage districts were organized to install drains in the Delta area, Sevier Valley and Sanpete Valley.

9.2.2 Past Water Planning and Development

The only storage reservoirs constructed since the 1936 Cox Decree were Three Creeks enlargement (1949), DMAD (1960), Manning Meadow (1967) and Nine Mile reconstruction (1982). Renovation work has also been done on Tropic, Gunnison, Gunnison Bend and Piute reservoirs and Panguitch and Palisades (Funks) lakes. During the 1950s and 60s, many of the major diversions and conveyance facilities were upgraded or replaced. All of these activities were carried out by local irrigation companies and individuals with additional financial and technical assistance by state and federal agencies.

Much of the water planning by the state of Utah has been and is now being done through the Division of Water Resources. The Board of Water Resources and its predecessor, the Utah Water and Power Board, have provided technical assistance for 276 projects by 1996 in the Sevier River Basin and funding of about $35.7 million. Federal and local entities have provided matching funds amounting to $16.4 million.

Board of Water Resources projects have included sprinkler irrigation systems, canal lining, pipelines, diversion dams, reservoir dams and repairs, wells, culinary water systems and stock watering facilities. The first Water and Power Board projects constructed in the basin were in 1948. These were Bullion Creek Irrigation Company pipeline, Gunnison-Fayette Irrigation Company diversion dam and West View Irrigation Company diversion dam. All board projects are listed in Table 9-l and shown on Figure 9-l. The column of the left of the Table 9-1 shows the project number with the numbering starting over for each county. These numbers show the project location on Figure 9-l. Where an irrigation company or city/town had more than one loan for the same type project, only one number is shown. More than one number is shown where an entity had different kinds of projects.

The Division of Water Quality does considerable planning to maintain water quality standards. The Water Quality Board provides financial and technical assistance by division staff. So far, loans and grants for these board projects are $5.3 million.

The Division of Drinking Water maintains and regulates drinking water. The Drinking Water Board has funded eight projects at a cost of $3.361 million.

Several federal projects have been completed. Generally, local sponsors were required to provide land easements and rights of way for each project and to supply cost-share funding in some cases. These descriptions follow.

The Corps of Engineers has completed three projects in the Sevier River Basin. The largest was the Redmond Channel Improvement Project completed in 195 1. The project consisted of 14 miles of improved channel along the Sevier River downstream from the mouth of Salina Creek, levees from the Westview Irrigation Company diversion dam to Redmond Lake Dam, and gated structures in place of two diversion dams to improve the carrying capacity of the river. The project protects the community of Redmond and about 3,000 acres of adjacent cropland. Federal cost was $919,000 and sponsor cost was $118,000. Channel and levee improvements were made under emergency authority in 1975 along Salina Creek through Salina. Also, in preparation for the 1983 flood, an emergency levee was constructed in Gunnison on the north bank of the San Pitch River adjacent to the U.S. Highway 89 bridge.

The Natural Resources Conservation Service (NRCS) has completed three watershed protection and flood prevention projects. The Pleasant Creek Pilot Watershed Project near Mt. Pleasant (where the Indians called "place of many floods") was installed to reduce erosion, floodwater and sediment damages and to make related irrigation system improvements. It was also a research watershed project designed to compare damage reduction from a treated watershed with damage from an untreated watershed. The project was completed in 1958 at a cost of $560,701. All of the costs except land, easements and rights-of-way were federal funds. Effectiveness of the project is shown by only $3,000 damages by one flood in 1955 when the watershed was 25 percent complete and another in 1961 causing no damage.

The Mill Canyon-Sage Flat Watershed Project is located in the drainage above Glenwood. Its purpose was to reduce floodwater and sediment damage in and around Glenwood. This was the first project completed (1959) in the United States under the Watershed Protection and Flood Prevention Act, PL-566. A major flood occurred during the final stages of completion. The flow exceeded 3,000 cfs above the flood control structure and was reduced to 15 cfs in the flood channel through town. Local citizens claim the project paid for itself by controlling this one flood.

The Glenwood Watershed Project (an amendment to the Mill Canyon-Sage Flat Project) was constructed (1975) to improve the use of the limited irrigation water supply. The project consisted of installing a gravity pressure sprinkler irrigation system on croplands served by the Glenwood Irrigation Company. It also included a pressure secondary water system for lawns and gardens in-the town of Glenwood. Total cost was $2,530,811 with the local sponsors contributing $570,785.

Table 9-1
BOARD OF WATER RESOURCES DEVELOPMENT PROJECTS

Sponsor	Number	Type	Year
GARFIELD COUNTY			
1. Bonanza Estates Water Co	1	Cl	1991
2. Long C.L. & East Bench Irr Co	1	Misc	1978
3. McEwen Canal Co, et al	1	Div Dam	1960
4. Panguitch City	2	Cl	1977,91
5. Panguitch City	1	ss	1982
6. West Panguitch Irr Co	1	DamRp	1975
7. West Panguitch Irr Co	3	PrPlSp	1979,83,85
Total-Garfield County	10		
JUAB COUNTY			
1. Central Utah Water Co	1	Div Dam	1974
2. Deep Canyon Irr Co	1	PrPl	1982
3. Eureka	1	ClW	1982
4. Juab Lake Irr Co	2	CL	1959,64
5. Levan Irr Co	1	CL	1955
6. Levan Irr Co	1	Irr Well	1959
7. Levan Irr Co	2	PrPl	1967,72
8. Levan Irr Co	2	Div Dam	1969,83
9. Levan Town	1	Cl	1985
10. Riverbed Irr Co	1	Irr Well	1957
11. Individual	1	Stk	1977
Total Juab County	13		
MILLARD COUNTY			
1. Abraham & Deseret Irr Co	1	DamRp	1983
2. Abraham Irr Co	2	CL	1977,91
3. Chalk Creek Irr Co	2	PrPlSp	1977.80
4. Chalk Creek Irr Co	1	Div Dam	1983
5. Corn Creek Irr Co	1	ss	1975
6. Corn Creek Irr Co	1	PrPl	1984
7. Corn Creek Irr Co	1	Div Dam	1984
8. Delta Canal Co	4	CL	1961,71,77,83
9. Delta Canal Co	1	Pl	1965
10. Delta City	1	Cl	1983
11. Deseret Irr Co	3	CL	1977,83,95
12. Deseret-Oasis SSD	2	Cl	1981,85
13. DMAD Company	2	DamErg	1959,83
14. DMAD Company	1	Irr Well	1974
15. East Leamington Irr Co	1	CL	1964
16. Fillmore City	2	Cl	1982,86
17. Fillmore Water Users Assoc	2	ss	1979,83

CL-Canal lining
Cl-Culmary system
ClW-Culinary system well
DamRp-Dam repair
Div Dam-Diversion dam
DamErg-Dam enlargement
Irr Well-Irrigation water well
Pl-Pipeline
PrPl-Pressure pipeline
PrPlSp-Pressure pipeline, Sprinkler
Spk-Sprinkler
Ss-Secondary water system
Stk-Stockwater well

Table 9-1 Continued --

BOARD OF WATER RESOURCES DEVELOPMENT PROJECTS

Sponsor	Number	Type	Year
18. Fool Creek Irr Co	2	Irr Well	1952,57
19. Fool Creek Irr Co	3	Cl	1965,73,92
20. Golden Harvester Irr Co	1	Irr Well	1959
21. Green Fields Irr Co	1	Irr Well	1964
22. Greenwood Irr Co	1	CL	1961
23. Hinkley Town	1	Cl	1983
24. Holden Irr Co	2	Div & Pl	1963,77
25. Kanosh Town	2	Cl	1980,85
26. Learnington Irr Co	1	CL	1983
27. Leamington town	1	Cl	1977
28. Lynndyl Irr Co	1	Irr Well	1957
29. Lynndyl Town	1	Cl	1983
30. McComick	1	CL	1961
31. McComick	3	Irr Well	1967,75,81
32. Meadow Irr & Canal Co	3	Irr Well	1950,51,61
33. Meadow Irr & Canal Co	2	CL	1953,71
34. Meadow Town	1	Cl	1980
35. Melville Irr Co	5	CL	1961,74,76,79,90
36. Northfields Irr Co	3	CL	1956,70,71
37. North McComick Irr Co	1	CL	1971
38. North McComick Irr Co	1	Irr Well	1958
39. Oak City Town	1	Cl	1985
40. Pahvant Development Co	2	Irr Well	1961,77
41. RCJJ Irr Co	1	Pl	1961
42. Scipio Irr Co	2	Irr Well	1957,61
43. Scipio Irr Co	1	ss	1977
44. Scipio Irr Co	2	CL	1984,89
45. Scipio Town	1	Cl	1984
46. Sinks Irr Co	1	Irr Well	1958
47. Sinks Land Co	1	Spk	1971
48. Taylor Flat Irr Co	2	Irr Well	1962
49. Walker Creek Assoc	1	Irr Well	1959
50. West Holden Irr Co	1	CL	1960
51. West Holden Irr Co	1	Spk	1977
52. Individual Ranchers	28	Stk	1977 & 78
Total-Millard County	112		
PIUTE COUNTY			
1. Beaver Creek Irr & Res Co	1	DamRp	1985
2. Bullion Creek Irr co	1	Pl	1948
3. Circleville & Loss Cr Irr Co	1	CL	1953
4. City Creek Irr Co	1	Spk	1974
5. Greenwich Waterworks Co	1	Cl	1974
6. Koosharem In Co	2	Spk	1982
7. Loss Creek Irr Co	1	CL	1960
8. Manning Meadows Res-Wildlife	1	Dam	1966
Total-Piute County	9		
SANPETE COUNTY			
1. Axtell Community SSD	1	CL Spk	1982
2. Birch Creek Irr Co	3	Spk	1978, 80, 81

Table 9-l Continued . .

BOARD OF WATER RESOURCES DEVELOPMENT PROJECTS

Sponsor	Number	Type	Year
3. Birch Creek Irr co	1	Div Dam	1983
4. Brady Ditch Co	1	CL	1968
5. Cedar Creek Irr Co	1	Pl	1985
6. Centerfield Town	1	Cl	1981
7. Chester Irr Co	1	Dam	1968
8. Chester Irr Co	1	Spk	1982
9. Cottonwood Gooseberry Irr Co	1	Tunnel	1967
10. Cottonwood Gooseberry Irr Co	2	Spk	1977,82
11. Cottonwood Gooseberry Irr Co	1	ss	1980
12. Ephraim City	2	Cl	1982,91
13. Ephraim Irr Co	3	Spk	1977,91,92
14. Ephraim Irr Co	1	Pl	1992
15. Excel1 Irr Co	1	CL	1963
16. Fairview City	1	Cl	1978
17. Fairview-Birch Crk Irr Co et al	1	Irr Well	1957
18. Fan-view-Birch Creek Irr Co	1	CL	1965
19. Fayette Water Co	1	Cl	1956
20. Fountain Green Coop Assoc et al	1	Irr Well	1960
21. Fountain Green Irr Co	3	CL	1959,60,61
22. Fountain Green Irr Co	4	PI-Spk	1975,77,83,95
23. George Sorenson Well Co	1	Spk	1977
24. Gunnison City	2	ClW	1978,91
25. Gunnison City	1	ss	1986
26. Gunnison City Canal Co	1	CL	1956
27. Gunnison Irr Co	3	Spk	1982,83,85
28. Gunnison Irr Co	2	DamRp	1981,83
29. Gunnison Irr Co	1	Pl	1986
30. Gunnison-Fayette Canal Co	1	Div Dam	1984
31. Gunnison-Fayette Irr Co	1	Dam	1948
32. Horseshoe Irr Co	5	Spk	1976,79,80,82
33. Horseshoe Irr Co	1	ss	1981
34. M & M Canal Co	1	Spk	1979
35. Manti City	1	Cl	1977
36. Manti Irr & Res Co	1	CL	1963
37. Manti Irr & Res Co	1	Spk	1977
38. Manti Irr & Res Co	1	ss	1980
39. Manti Irr Co	1	Spk	1979
40. Manti Irr Co	1	ss	1977
41. Mayfield Irr Co	1	CL	1960
42. Mayfield Irr Co	3	Spk	1983,87,91
43. McArthur Frandsen Ditch Co	1	CL	1976
44. Milbum Dry Creek Irr Co	1	Spk	1979
45. Milbum Irr Co	1	Spk	1981
46. Moroni City	1	Cl	1982
47. Moroni Irr Co	2	CL	1969
48. Mt. Pleasant Big Ditch Irr Co	1	Pl	1970
49. Mt. Pleasant City	2	ss	1983,87
50. Mt. Pleasant City	1	Cl	1992
5 1. North Creek Irr co	1	CL	1965
52. Pleasant Creek Irr Co	2	Spk	1977,82

Table 9-l Continued --
BOARD OF WATER RESOURCES DEVELOPMENT PROJECTS

Sponsor	Number	Type	Year
53. Rock Dam Irr Co	1	CL	1957
54. Rock Dam Irr Co	2	Div Dam	1962,85
55. Sanpete-Oak Creek Irr Co	1	Spk	1978
56. South Extension Canal Co	1	CL	1961
57. Spring Canyon Irr Co	1	Spk	1980
58. Spring City	2	Cl	1976,84
59. Sterling Irr Co	1	Spk	1977
60. Sterling Town	1	Cl	1980
6 1. Wales Irr Co	2	PrPlSp	1971,82
62. West View Irr Co	1	Dam	1948
63. West View Irr Co	1	CL	1966
64. Willow Creek Irr Co	1	CL	1967
65. Willow Creek Irr Co	1	Div Dam	1983
Total-Sanpete County	93		
SEVIER COUNTY			
1. Annabella Irr and Canal Co	2	CL	1974,83
2. Annabella Irr and Canal Co	2	Pl	1981,92
3. Aurora City	1	Cl	1978
4. Austin Community SSD	1	Cl	1982
5. Brooklyn Tap Line Co	1	Cl	1994
6. Cedar Ridge Irr Co	1	CL	1963
7. Central Waterworks Co	3	Cl	1952,73,94
8. Cottonwood Res & Irr Co	1	Spk	1971
9. Cottonwood Res & Irr Co	1	ss	1972
10. Dry Creek Irr Co	1	Pl	1968
11. Elsinore Town	1	Cl	1979
12. Glenwood Irr Co	2	Spk	1976,87
13. Joseph Irr Canal Co	1	CL	1979
14. Joseph Town	1	Cl	1981
15. Kings Meadow Ranches, Inc	1	Pl	1959
16. Koosharem Irr Co	1	CL	1961
17. Koosharem Irr Co	1	ss	1986
18. Koosharem Town	1	Cl	1977
19. Monroe City	1	ss	1981
20. Monroe South Bend Canal Co	1	CL	1983
21. Monroe South Bend Canal Co	1	Div Dam	1985
22. Monroe South Bend Canal Co	1	Pl	1992
23. Otter Creek Reservoir Co	1	CL	1983
24. Piute Reservoir & Irr Co	1	Div Dam	1984
25. Redmond Lake Irr Co	1	Pl	1994
26. Redmond Town	1	Cl	1977
27. Richfield City	1	Cl	1987
28. Richfield Irr Canal Co	1	Div Dam	1989
29. Salina City	2	ss	1980,84
30. Salina City	1	Cl	1986
3 1. Salina Creek Irr Co	1	Pl	1961
32. Vermillion Irr Co	1	Div Dam	1990
33. Wells Irr Co	1	CL	1993
Total-Sevier County			

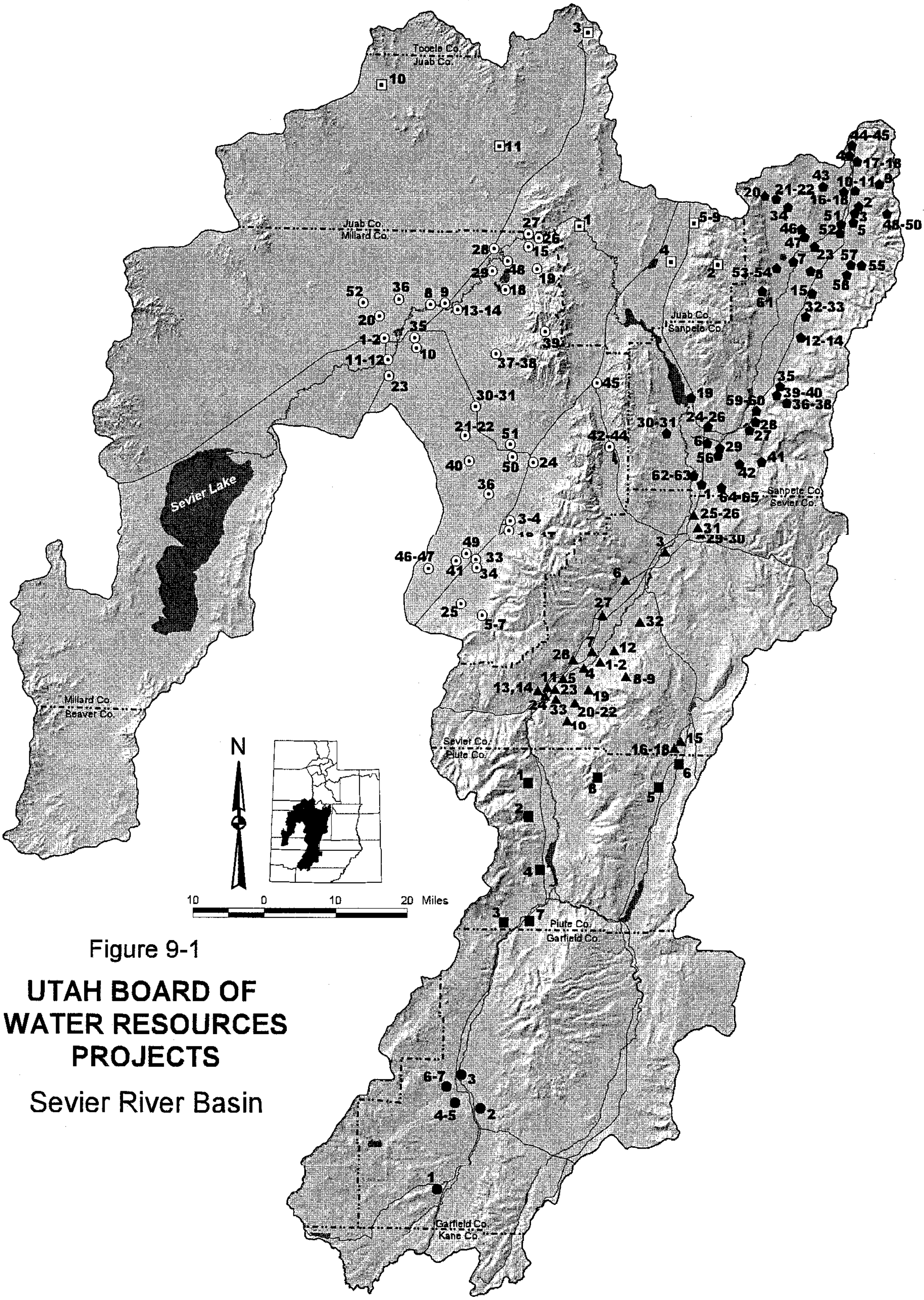


Figure 9-1

UTAH BOARD OF WATER RESOURCES PROJECTS

Sevier River Basin

NRCS also completed the Richfield Flood Hazard Study (1974) to determine flood plain zones for compliance under Federal Emergency Management Agency regulations. Also, a plan of work and an environmental impact statement were prepared for the Richfield-West Sevier Watershed Project (1977).

9.2.3 Current Water Planning and Development

Major reservoir storage projects are among those things remembered because of the hard work and sacrifice and they are not forgotten because of the rewards. The Cox Decree determinations in 1936 has reaffirmed most of the Higgins and Morse Decrees and brought about some other changes in development on the Sevier River by establishing a water right structure. In addition, much of the irrigated acreage data in "Bacon's Bible" was referenced. The Cox Decree has made construction of storage reservoirs unlikely and the magnitude of other irrigation projects smaller as they may affect the established water rights. As a result, most current irrigation projects are designed to improve delivery and irrigation efficiencies and/or reduce labor costs.

Most of the larger current (1999) project planning and development projects are receiving assistance from the Board and Division of Water Resources. The dam safety projects are to help owners bring their reservoir dams into compliance with the dam safety requirements. These projects are as listed:

- Palisade Lake Water Users Association is replacing 1,000 feet of irrigation pipeline.
- Sanpete Water Conservancy District in conjunction with Manti Irrigation Company, is converting 1,600 acres from flood to sprinkler irrigation.
- Spring City is improving their culinary water system and constructing a new 250,000-gallon storage tank.
- Redmond Town is upgrading their culinary water system.
- Deseret Irrigation Company is lining parts of their canal system.
- Koosharem Irrigation Company is replacing part of their canal lining which has failed.
- Dam safety studies have been authorized and funded for 11 dams. Seven of the studies are complete and awaiting corrective action. One is starting construction.
- Manti City is upgrading its culinary water system.
- Fairview City is making culinary water system improvements.
- Gunnison-Fayette Irrigation Company is doing diversion dam rehabilitation/reconstruction.
- Westview Irrigation Company is doing diversion dam rehabilitation/reconstruction.
- Otter Creek Reservoir Company is doing Dam Safety construction.

The Division of Water Quality is conducting a water quality study in the Sevier River Basin. This study will also investigate potential projects to improve surface water and groundwater quality.

In the early 1990s, the Division of Wildlife Resources requested the Corps of Engineers to investigate further environmental restoration of the Redmond Channel Project. This project would restore meanders to improve fish and wildlife habitat. Because of water users protests, the Division of Wildlife Resources has decided to put this restoration on hold indefinitely.

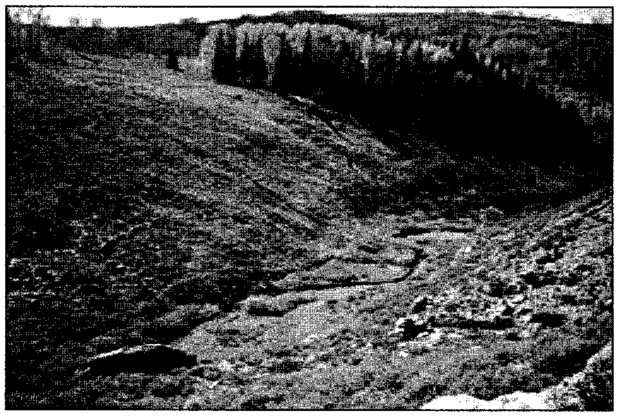
The Natural Resources Conservation Service is continuing -work on the Monroe-Annabella Watershed Project, originally authorized in 1961. Project features include upper watershed and foothill area land treatment, structural measures to reduce erosion and floodwater, and improvements to several irrigation systems. This will also protect downstream urban property and utilities. The project will be complete when the current irrigation measures are finished.

Manti Irrigation Company is installing an irrigation system with gravity and pumped sprinkler irrigation and flood irrigation.
The project includes 2,700 acres of irrigated cropland with a total cost of $4.0 million. A loan of $1.5 million will come from the Board of Water Resources and $1.9 million from the Water Conservation Credit Program through the Central Utah Water Conservancy District.

Hatch Town Dam and Reservoir - Several attempts have been made to develop plans for a water storage reservoir near Hatch since the third failure of the Hatch Town Dam in 1914. These have all failed because of water rights problems. The Division of Water Resources prepared an engineering feasibility report in 1974 for a structure at the site. In 1984, the division contracted for geological and engineering investigations at the original site as part of the state water planning effort. The division also conducted a study of a dam site about 600 feet downstream from the original location. A report was completed in 1986 concluding a safe dam could be built at either the upper or lower site. The lower site was recommended because of better conditions and less cost.

There is still the possibility of long-term storage on the upper Sevier river at the Hatch Town Dam site. The reservoir would have to be filled during years of high runoff. A transfer of water rights and abandonment of irrigated lands, probably in the upper Sevier River area, would be necessary. This is because the original water rights were sold to Piute Reservoir and Irrigation Company. Constructing the dam and filling the reservoir would require innovative planning and operation to reduce the downstream impact. The principal purpose of the reservoir could be for recreation and for releasing high quality water to dilute the total dissolved solids in late-summer downstream flows.

In their August 1998 meeting, the Central Utah Water Conservancy District Board voted to consider construction of Hatch Town Dam in Garfield County. An updating of construction costs and discussions with the State Engineer were started. Assistance for other projects in those counties still part of Central Utah Water Conservancy District has also been requested.



Narrows Reservoir site

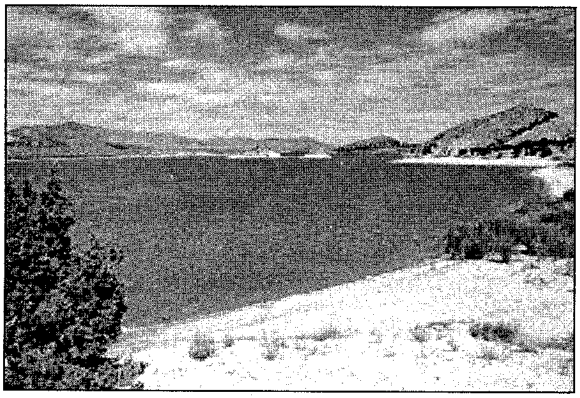
Narrows Project - There is the possibility of bringing additional water into the basin through the Narrows (Gooseberry) Project in Sanpete County. A Draft Environmental Impact Statement was issued in March 1998 with public hearings in April 1998.

The Narrows Project would divert water from Gooseberry Creek in the Price River drainage into the San Pitch River drainage for agricultural and municipal and industrial water uses. The project includes a dam and reservoir on Gooseberry Creek with a capacity of 17,000 acre-feet of which 14,500 acre-feet would be active storage. The water would be diverted through the existing Narrows Tunnel into Cottonwood Creek, a tributary of the San Pitch River. The Narrows Tunnel has deteriorated and will require restoration. Pipelines would deliver 5,400 acre-feet of water annually; 4,920 acre-feet to canals for supplemental irrigation of 15,420 acres of irrigated land in the Fairview, Mt. Pleasant, Spring City and Moroni area and 480 acre-feet of municipal and industrial water for residential outside uses.

Other project features would add to or mitigate other affected resources. The project would include realigning about one mile of State Road 264. Recreation facilities would be built around and in connection with the proposed reservoir. There will also be measures mitigating the fishery, wetlands and wildlife values that are impacted by the project.

The original Gooseberry Project Report of 1940 described a project conceived during the 1930s. It included the Gooseberry Reservoir and Tunnel, Mammoth Reservoir and Tunnel, the Gooseberry Highline Canal and a number of feeder canals. These facilities would divert water from the headwaters of the Price River and Huntington Creek into Sanpete Valley. The project would enlarge Scofield Reservoir on the Price River to enable complete diversion of water to meet the needs in the Price area.

Scofield Reservoir was reconstructed and enlarged during World War II because it was unsafe and to ensure water for power production needed in the war effort. As part of the Scofield Reservoir construction work, the Bureau of Reclamation; 1) Increased the capacity of the reservoir by over 30,000 acre-feet, 2) established an operational plan which specifically provided for the transmountain diversion features of the Gooseberry Project, and 3) obtained a subordination of all Price River Water Users Association's water rights to the Gooseberry Project transmountain diversion rights. Work has since been completed to increase the Scofield Dam's resistance to earthquakes.



Sevier Bridge Reservoir

Following the war, several planning efforts were undertaken to complete the Gooseberry Project. In 1964, the Narrows Tunnel was constructed. Soon, controversy developed over the final project feature, Gooseberry Dam. The controversy was thought to be resolved by; 1) A ruling by the Utah Supreme Court in 1982 reaffirming the binding effect of the Scofield Reconstruction and Repayment Contracts, 2) a Tripartite Agreement between Sanpete Water Conservancy District, Carbon Water Conservancy District and Price River Water Users Association concerning building of storage and diversion works on the Price River System for transmountain diversion from Gooseberry Creek to the San Pitch River System (this was upheld by the Utah Supreme Court in July 1987), and 3) a 1989 agreement with the U.S. Department of Justice whereby the United States subordinated its federal reserve water rights to the Gooseberry Project.

The future of the project now depends on the outcome of the recent public hearings. If the decision is favorable, the project could be implemented, however there is still opposition by Carbon County and environmental groups.

9.2.4 Environmental Considerations

Water resources both reflect and shape the environment of an area. Most of the streams flow through forested lands where there is high quality water providing opportunities for fishing, hunting, camping, hiking and other outdoor recreational activities. Some of these streams are accessible by automobile, others lend themselves more to horseback riding or hiking.

Streams in the upper watershed areas should remain in their original meandering channels. This prevents erosion and helps maintain the original riparian vegetation. Channels in the downstream areas often need more capacity to carry high flows of water. In some cases, it may be necessary to modify the channels to prevent damages to surrounding areas.

The primary reason for the construction of storage reservoirs has been to provide reliable irrigation supplies. However, instream flows were an incidental benefit that supports fisheries during the summer when natural flows would be too low. A water right is required if instream flows are to be maintained. Just the presence of water, whether it is a stream or a reservoir, makes more pleasing surroundings.

9.3 WATER RESOURCES PROBLEMS

The Sevier River main stem is one of the most efficiently used river systems in the United States as only 4 percent of the total yield reaches Sevier Lake. Most of this is intermittent flood flows and small amounts of groundwater and drainage system's outflow. Although the water resources are already highly developed, numerous management problems remain. As demand increases, driving the value of water higher, there will be increasing problems. There are basinwide water supply and use problems as well as those peculiar to the various subareas along the Sevier River.

9.3.1 Water Regulation Problems

The areas of the Sevier River above Circleville have only one surface water storage facility. As a result, the irrigation water supply in areas without storage is more than adequate during the early part of the irrigation season but is more limited during late summer, especially in drier years. Water users tend to divert more water than is needed or their rights allow early in the season when the runoff is high.

Although this over-application (diversion) reappears as return flow later in the year, it is also lower in quality. This same thing happens in other areas of the river system. As a result of this diversion, return flow, diversion, a "regime of the river" has been established.

There are other places along the river system, in Pahvant Valley and in the Levan area where small reservoirs to regulate flows would be an advantage in making best use of available water supplies. One example is a recently approved small reservoir in the lower end of the Highland Canal on the Gunnison Irrigation Company system. Other potential sites are on the lower end of Panguitch Creek and on Chicken and Pigeon creeks. Also, small reservoirs on Chalk Creek and Corn Creek would help regulate the stream flows. These reservoirs could regulate flows on the short-term for use later and may even improve the water quality.

9.3.2 Water Quality Problems

Water quality is a problem in the lower parts of the Sevier River, especially from Rocky Ford Reservoir downstream. In August 1988, the surface water quality south of Redmond was 1040 mg/L and the groundwater quality as measured in a well east of the river was 450 mg/L. The San Pitch River was measured at 920 mg/L below Gunnison Reservoir. Part of the increased pollution in the Sevier and San Pitch rivers comes from the Arapien shale in the Glenwood-Sigurd area and along the west side of Sanpete Valley. The Arapien shale in Southern Juab Valley contributes salts to flows into Chicken Creek Reservoir. Over-irrigation also leaches salts into the surface water and groundwater. As water is diverted, used for irrigation, reappears as return flow and is again diverted, additional salts are leached from the soil profile and concentrated in the river flow. The Sevier River at Lynndyl contained 1,025 mg/L in August 1988 with 281 cfs. Winter flows during 1988 reached 2,340 mg/L at 29 cfs.

Water quality is becoming the major problem in Pahvant Valley. This is the result of the small volume of groundwater outflow compared to the tributary inflow along with reuse of the groundwater. The high quality streamflow (240-435 mg/L)[58] is applied to the cropland and, as it percolates through the soil profile, it leaches salts into the groundwater reservoir. As groundwater is pumped for irrigation, it percolates down through the soil profile again, leaching more salts into the groundwater reservoir. This has slowly increased the total dissolved-solids to 765 mg/L (1,300 µS/cm) in the McCornick area and to more than 1 ,118 mg/L (2,000 µS/cm) in areas west of Meadow. The total dissolved-solids have increased from about 1,770 mg/L (3,000 µS/mg) in an area southwest of Black Rock Volcano during the period 1957-67 to nearly 5,310 mg/L (9,000 µS/cm) during the 1977-87 period.

The groundwater reservoir level has been declining over parts of Pahvant Valley due to well withdrawals in excess of recharge. The State Engineer has prepared a water management plan to protect the groundwater resources within the existing water law.

The groundwater quality also deteriorates in lower Southern Juab Valley and Mills Valley.[59] The water in upper Chicken Creek has been measured from 141 mg/L to 593 mg/L (240 to 1,005 µmhos/cm). The outflow from Chicken Creek Reservoir was measured at 780 mg/L (1,320 µS/cm) on November 17, 1993. A sample taken two miles downstream from Chicken Creek Reservoir in 1963 was measured at 4,290 mg/L (7,270 µmhos/cm) with a flow of 0.5 cfs. Chase Spring in Mills Valley was measured at 1,125 mg/L (1,910 µmhos/cm) at a flow of 3.1 cfs on June 13, 1963. The U.S. Geological Survey made a seepage run during October 1963 with water quality measurements as follows: Gage near Juab (just below the outlet of Sevier Bridge Reservoir), 1,800 mg/L (3,050 µmhos/cm) at 3.3 cfs; railroad crossing near Mills (below Blue and Mohlen springs) 725 mg/L (1,230 µmhos/cm) at 33.3 cfs; and at the head of Leamington Canyon, 710 mg/L (1,200 µmhos/cm) at 30.2 cfs.[11] This shows the dilution effect of good quality spring water on poor quality groundwater inflow. See Appendix A for the definition of water quality units of measurements.

9.3.3 Groundwater Development Problems

During a U.S. Geological Survey study, data was analyzed to determine the effect of irrigation water diversions in the upper Central Sevier Valley on two downstream wells, one on each side of the river.[39] Data was analyzed for 1987 and 1988.

One well was about two miles southeast of Elsinore and about one mile southeast of the Sevier River. The lag time from the high point of the diversions to the lowest well water level was about six months. The well water level ranged from two feet above to 3 ½ feet below average. The other well was about three miles southeast of Richfield near the northwest side of the Sevier River. The lag time was about eight months and the well water level varied from one foot above to 1 ½ feet below average.

Earlier studies by the U.S. Geological Survey described the relationship of the water level in an artesian well to the discharge of alluvial springs north of the Hepler Ponds.[79] During 1959, each foot of drop in the well water level reduced the spring flow about 1.7 cfs.

These studies indicate the direct relationship between the regime of the Sevier River, the groundwater levels and the discharge from springs. Any change in discharge from the system will probably impact other water rights.

Withdrawals from groundwater has been increasing at a faster rate in recent years because of the large number of small domestic wells being drilled. Domestic wells have been drilled to supply water for homes in the valley areas outside public water supplier service areas. Wells are also being drilled for summer home sites in the mountain areas throughout the basin.

The construction of more domestic wells is beginning to impact the groundwater in several ways. The use of this water will eventually have an effect on the spring flows in the area as well as on groundwater outflow to the river system. When a domestic well is developed, a spetic tank will also be installed. This will contribute to the contamination of the groundwater. Septic tanks are already becoming a pollution problem in the Fait-view, Levan, Monroe, Moroni and Mt Pleasant areas where populations are increasing at a faster rate.

There are 57 public community water systems supplying culinary water. All of these systems depend on groundwater (springs or wells) for their water supply. There are only six systems where existing supply will not be adequate to meet the needs of the projected population in the year 2020. The projected 1997-2020 population increase and the portion current water supplies wil serve are shown in Table 9-2

Table 9-2
COMMUNITIES WITH WATER SHORTAGES BY 2020

Community	Projected Growth	Growth Served by Existing Supply (no. of people)	Shortage (acre-feet)
Sanpete County			
Centerfield	503	502	Neg.
Fountain Green	543	0	136
Total	1,046	502	136
Sevier **County**			
Elsinore	399	216	54
Glenwood	299	211	53
Richfield	4,387	1,118	280
Salina	1,449	312	78
Total	6,534	312	465

Note: Projected supplies could be limited by water rights or by system capacity.

In March 1997, the State Engineer put a moratorium on all new appropriations of groundwater. The surface water has been closed to new appropriations since 1946. The growing number of new appropriations created a cumulative effect on downstream water rights. The most common appropriations were for domestic water rights entitling the user to not more than two acre-feet per year. Installation of more domestic water wells affects both the timing and the total volume of the return flow. With the groundwater moratorium in place, the total additional amount of groundwater diverted will be less.

It is still possible to drill a new domestic well under an existing approved filing. Otherwise, a water right would have to be purchased from another source such as stock in an irrigation company. Under this option, a change application would have to be filed requesting a change in point of diversion, place and purpose of use. If stock from an irrigation company is purchased, only the amount of water that would be depleted can be transferred. In addition, the place of use cannot be in another groundwater basin. Obtaining water through this means will become more difficult as irrigation companies are reluctant to allow transfer of stock out of the company. In fact, many irrigation companies in the basin are amending their bylaws to prohibit such actions.

Population increases in areas outside those served by public community systems will continue to demand increased amounts of water. The 1997 population of 9,495 people in the unincorporated areas is projected to increase to 12,616 people by 2020, an increase of 3,121 people. Assuming the same use rate with no conservation measures applied, the increased demand would be 960 acre-feet for domestic use in the unincorporated areas.

Table 9-3
CURRENT (1991) AND PROJECTED AGRICULTURAL WATER USE

County	1991 Diversions	1991 Depletions	2020 Diversions	2020 Depletions
Garfield	67,840	39,500	67,240	39,270
Iron	1,010	590	1,000	580
Juab	25,300	14,770	25,080	14,650
Kane	720	420	710	410
Millard	294,330	171,960	291,770	170,380
Piute	66,540	38,860	65,960	38,520
Sanpete	251,210	146,760	253,940[a]	148,300
Sevier	196,510	114,720	194,800	113,750
Total	903,460	527,580	900,500	525,860

[a] Includes imports from Narrows Project in Sanpete County.

9.4 WATER USE AND PROJECTED DEMANDS

Irrigated agriculture is the largest water user in the Sevier River Basin with depletions of 63.17 percent of the total use. The current use of water for municipal and industrial purposes is small, only 5.38 percent of the total use, however, this will be an increasing demand on the limited water supply.

9.4.1 Agricultural Water

Irrigation water supply and use have remained relatively stable over the years, fluctuating only with changes in precipitation cycles. Where there has been a change in total irrigated cropland areas, this has been according to the available water supply. Other factors have also had some influence such as the Intermountain Power Project.

Irrigation water use was about 10,000 acre-feet in 1850 when only 2,520 acres were under irrigation. By the turn of the century, this had increased to about 800,000 acre-feet. The current diversions are 903,460 acre-feet, but are to decrease slightly to 900,500 acre-feet by 2020 as agricultural water is converted to municipal projected and industrial uses. The current and projected demand is shown in Table 9-3. Refer to Section 10 for more information on irrigation water use.

9.4.2 Municipal and Industrial Water Use

New municipal and industrial water projects are usually formulated to develop additional water supplies. There is also a need to replace, update and expand existing community drinking water systems with a growing population.

Industrial use represents only a small portion of the total basin water use. Future industrial water use may increase as new industries are established. The present self-supplied industrial water use is 25,120 acre-feet. Also, there is an additional 1,170 acre-feet of culinary water supplied by public community systems for industrial use.

The demand for culinary water will grow as the population increases. The curent and projected demand for culinary water is given in Table 9-4.

9.4.3 Secondary Water

Communities are making increased use of secondary (dual) water systems to limit demand on their culinary water supply. There are 47 communities with secondary systems installed. The current and projected secondary water use is shown in Table 9-5.

Table 9-4
CURRENT (1996) AND PROJECTED CULINARY (M&I) WATER USE[a]

County	1996 Diversions	1996 Depletions	2020 Diversions	2020 Depletions
	(acre-feet)			
Garfield	500	250	710	360
Juab	560	280	740	370
Millard	3,730	1,870	5,120	2,560
Piute.	450	220	640	320
Sanpete	3,720	1,860	6,180	3,090
Sevier	5,360	2,680	8,460	4,230
Total	14,320	7,160	21,850	10,930

[a] Includes water delivered by public community systems only.

Table 9-5
CURRENT (1996) AND PROJECTED SECONDARY (M&I) WATER USE

County	1996 Diversions	1996 Depletions	2020 Diversions	2020 Depletions
	(acre-feet)			
Garfield	310	220	440	300
Juab	neg.[a]	neg.[a]	neg.[a]	neg.[a]
Millard	1,220	850	1,680	1,180
Piute	120	80	170	120
Sanpete	3,790	2,650	6,770[b]	4,740
Sevier	3,150	2,210	4,970	3,480
Total	8,590	6,010	14,030	9,820

a Levan diverts about 800 acre-feet of culinary quality water from an irrigation water well into the public water supply system which includes lawn and garden uses.

b Includes 480 acre-feet import from Narrows Project.

9.4.4 Recreational Water Use

All of the reservoirs provide some type of recreation. The larger water areas such as Piute, Otter Creek and Sevier Bridge (Yuba Lake) reservoirs provide nearly 16,000 surface acres for boating, fishing and water skiing. In addition, the smaller reservoirs are used for fishing and asdestination sites for camping, picnicking and other recreational activities. See Section 15, Water-Related Recreation for more information.

9.4.5 Environmental Water Needs

A significant portion of the water supply is used to support riparian vegetation and wetlands. Instream flows provide habitat for fish and wildlife. Phreatophytes provide cover and food for wildlife. There are 92,000 acres of wetlands and small open water areas including 25,340 acres of riparian vegetation determined from the Division of Water Resources 1990s land-use surveys. These include natural as well as man-made areas. These areas deplete 262,620 acre-feet of water. Most of these areas act as natural filters, removing some nutrients and other pollutants from the waters flowing through them.

9.4.6 Water Use Summary

All current water use and projected demands are based on currently available data. These are shown in Table 9-6 for 1996, 2020 and 2050. Figure 9-2 shows current and projected water demands.

The industrial use represents only a small portion of the total basin water use. Future industrial water use may increase as new industries are established. The present self-supplied industrial water use is 25,120 acre-feet. Also, there is an additional 1,170 acre-feet of culinary water supplied by public community systems for industrial use.

9.5 WATER DEVELOPMENT AND MANAGEMENT ALTERNATIVES

All water resources in the Sevier River Basin are considered to be appropriated. The only way to meet additional water demands is by changing from one use to another or at different locations. The supply can continue to be enhanced through cloud seeding.

Table 9-6
SUMMARY OF CURRENT AND PROJECTED WATER DEMANDS

	Year					
	1996		2020		2050	
Use	Diversions	Depletions	Diversions	Depletions	Diversions	Depletions
	(acre-feet)					
Municipal and Industrial						
Industrial[a]	25,120[c]	22,610	29,040	26,140	30,960	27,860
Culinary	23,360	16,350	33,190	23,230	37280	26,100
Secondary	8,590	6,010	14,030[f]	9,820	16,110	11,280
Irrigation[b]	903,460[d]	527,580	900,500[g]	525,860	887,990	518,570
Wet/Open[b] Areas	216,710	216,710	216,710	216,710	216,710	216,710
Net Evaporat.[b] (Major revors.)	45,910	45,910	45,910	45,910	45,910	45,910
Basin Total	1,223,150[e]	835,170	1,239,380	847,670	1,234,960	846,430

[a] Assumes use by Intermountain Power Projects remains constant.
[b] Based on 1985 land use surveys.
[c] Does not include 1,170 acre-feet supplied by public community systems.
[d] Current use of 903,460 acre-feet is for 1991.
[e] Includes return flows as water is diverted more than once.
[f] Includes 480 acre-feet from the Narrows Project in Sanpete County.
[g] Includes 4,920 acre-feet from the Narrows Project

9.5.1 Water Supply Management

Construction of small surface water reservoirs at selected locations may be a way of controlling some water supplies for local groups or individuals. These would be operated as a short-term storage reservoir rather than for long-term storage.

Real-Time Control - Automated stations can be a more efficient way to regulate the diversion of water from the river and stream systems. These systems can be operated by remote control to regulate gates at canal diversion structures, saving trips for the water master and allowing better response times. Automated systems can be adjusted to change the diversion depending on the call for water or in case of sudden flood flows. Some additional work will be required to adapt each station for automation but this can be done by the river commissioner thus saving installation costs. The stations will also have to be protected from vandalism. Some of these systems are now in use in the Richfield and Delta areas. Automation can also be used at gaging station sites to obtain real-time data.

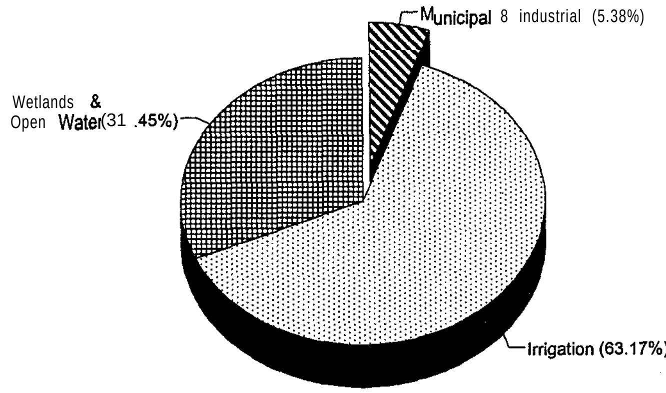
9.52 Groundwater Management (Conjunctive Use)

Some communities are now and soon will be facing a shortage of culinary water as the demand for water increases to meet the needs of an expanding population. The challenge facing water managers is to devise ways to conjunctively use the surface water and groundwater and not adversely impair prior rights. Some alternatives include the following. These are not listed in order of priority.

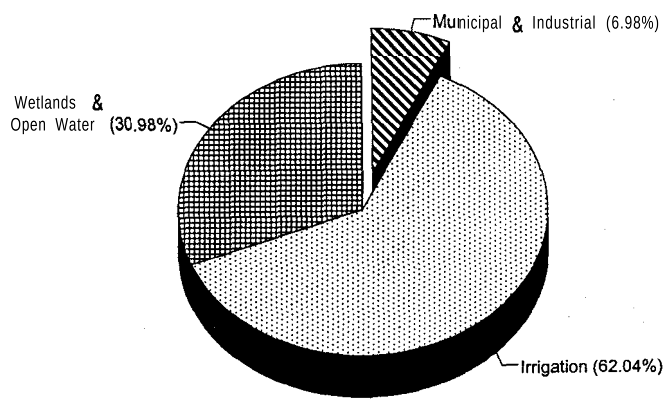
- Utilizing the groundwater reservoirs
- Using treated surface water supplies
- Restricting home construction in areas outside existing community service areas
- Expanding the present community service areas
- Conversion of agricultural water to municipal and industrial uses
- Increasing the use of secondary systems to reduce the demand for culinary water

Sevier River Basin

Water Depletions 1996



Water Depletions 2020



Water Depletions 2050

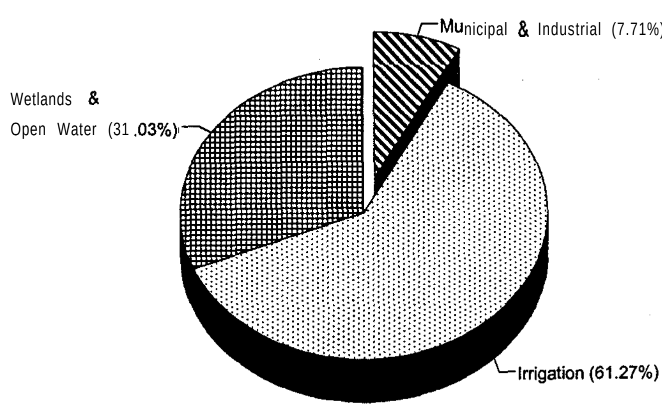


Figure 9-2

CURRENT AND PROJECTED WATER DEMANDS

Planning for future needs may involve one or a combination of the above alternatives. This will require a cooperative approach which should involve all the prior right holders. New users of culinary water should be assured a firm, dependable supply. At the same time, impacted water right holders will have to be compensated.

Recent studies were conducted by the U.S. Geological Survey in in the Sevier River Basin[30,31,33,52,68] These studies have indicated if more groundwater is pumped or additional acreages changed from flood to sprinkler irrigation, there would be an impact on the river system hydrology.

This impact would vary from basin to basin. Models were based on a simplified set of assumptions regarding the hydrologic system but appear to adequately represent the physical conditions. The varying data on groundwater inflow from consolidated rocks around the boundary and the groundwater reservoir strata, i.e., clay/sand-gravel layers, were not completely modeled. However, as indicated in the reports, the actual results would probably have less impact than shown by the simulations.

Table 9-7 shows the results of a simulation using increased pumpage from the Sevier-Sigurd Basin.[33] Similar studies were performed for Panguitch Valley, Sanpete Valley, Pahvant Valley and Sevier Desert.

Decreases in discharge from groundwater would be spread over several uses. The largest impact would be seepage to the Sevier River. Computed groundwater-level declines of less than six feet occurred over most of the area.

More detailed studies are needed because of the complex relations between the surface water and the groundwater. Additional data collection is needed to improve estimates of discharge to the Sevier River and to the large alluvial springs.

Another alternative has been discussed - tapping the deep aquifers below 800 feet for additional water. However, the water quality is poor in many areas where deep wells have been drilled. This could be a potential for future consideration.

9.5.3 Cloud Seeding

The Utah Cloud Seeding Program has the goal of increasing winter precipitation within targeted mountain watersheds. Enhanced winter snowpack leads to additional streamflow runoff and underground water storage during the spring and summer months.

Operational cloud seeding is a relatively lowcost method of increasing water supplies. The state, through the division and Board of Water Resources, cost-shares with local sponsors for cloud seeding projects. The effectiveness of a cloud seeding project cannot be determined without several years of operation, because of the wide variability in the weather from year to year.

Evaluations have been made of the Central and Southern Utah Project precipitation and snowpack water content data from gage sites within the areas affected by cloud seeding. These evaluations indicate that over the long term (since cloud seeding began in 1974), snowpack water content is averaging about 9 percent more each seeded season than would have been expected at highly correlated unseeded sites. Total precipitation through the bulk of the winter period (December-March) has been increased by more than 14 percent on the average when compared to the most probable amount predicted by statistical analyses.

Cloud seeding is most effective when it is continued over several years providing increased soil moisture, increased groundwater for springs, and maintaining base flows. Seeding only in dry years may not be as effective because of a lack of seedable storm systems.

The cloud seeding program covers all of the counties in the Sevier River Basin. This program has provided additional water supplies through increased surface water flows as well as more groundwater inflows to the valley areas. Increased groundwater is especially valuable as the delayed regime provides flows during the late summer when additional water is needed.

9.5.4 Water Education

Numerous programs are available for promoting water education. The annual Young Artists' Water Education Poster contest is an event which continues to be the highlight of October, Water Education month. Children in kindergarten to 6th grade participate in this statewide contest each year. Themes chosen each year all relate to water as a

Table 9-7
SIMULATED EFFECTS OF GROUNDWATER PUMPING FOR CENTRAL SEVIER VALLEY

Item	Steady-State (acre-feet)	Effects Prediction at End of 20-year Period with 15,000 AF Increased Pumpage (acre-feet)	Change (acre-feet)
Seepage from precipitation	2,200	2,200	0
Seepage from irrigation	43,200	43,200	0
Inflow from consolidated rock	10,600	11,600	1,000
Seepage from canals	9,000	9,000	0
Seepage from Sevier River	8,400	12,000	3,600
Seepage from other streams	14,200	14,200	0
Storage		200	200
Total	87,600	92,400	4,800
Discharge			
Evapotranspiration	14,600	13,300	-1,300
Seepage to Sevier River	29,800	26,700	-3,100
Springs	18,900	16,500	-2,400
Drains	12,100	9,900	-2,200
Pumping wells	1,100	17,500	16,400
Flowing wells	8,600	6,000	-2,600
Subsurface outflow	2,500	2,500	0
Total	87,600	92,400	4,800

Source: U.S. Geological Survey and Division of Water Rights Technical Publication 103.

resource. The same amount of water exists today as when earth was first formed. However, demand for water keeps increasing. According to some water resources specialists, water usage has tripled since 1950. Human needs have to be satisfied while protecting the ecological integrity of natural systems. Communities need to balance their use of water with their responsibility for its quality and availability. These and other problems will continue to confront us into the 21st century. Finding the answers depends on a populace sensitive to and knowledgeable about water and related resources. Education provides one of the best approaches to ensuring responsible behavior toward water. Project WET (Water Education for Teachers), through its education services and programs, will help prepare students for citizenship in the next century.

The goal of Project WET is to facilitate and promote awareness, appreciation, knowledge and stewardship of water resources. This is done through the development and dissemination of classroom-ready teaching aids and through the establishment of state and internationally sponsored programs.

Project WET is sponsored in Utah by the Division of Water Resources. A state coordinator supervises the training of public and private school teachers in a workshop setting where innovative water related, hands-on, and fun activities prepare them for classroom successes. Water fairs can be conducted in individual schools where classes are taught by teachers trained in Project WET workshops and by trained local water professionals.